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TRINIDAD PALEOCENE AND LOWER EOCENE GLOBIGERINIDAE

By

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TRINIDAD PALEOCENE AND LOWER EOCENE GLOBIGERINIDAE

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INTRODUCTION

The investigation of Trinidad Globigerinidae (Bronnimann, 1952) is continued in the present paper by the description of 12 of the more prominent *Globigerina* and of one *Globorotalia* species. The Foraminifera originate from the type locality assemblages of the Paleocene Soldado and Lizard Springs formations and from the lower Eocene Ramdat marl of the Navet formation, as well as from a heterogeneous mudflow fauna encountered in the Kapur Ridge-Stone River area, southeastern Trinidad. Some of the pelagic species, excluding the Globigerinae, have been reported on by Cushman and Renz (1942, 1946, 1948), who also supplied data on locality, age, and lithology of the type samples. The observation and catalogue numbers mentioned in the following refer to samples collected at the type localities mainly by H. G. Kugler and H. H. Renz. The mudflow sample Sh. 100, T.L.L. Cat. No. 143838, was collected by M. F. Shepherd. The figures on Plates 1-3 are Abbé Mirror drawings by the author.

STRATIGRAPHIC DISTRIBUTION

The type locality samples were analyzed in detail and the following species determined or named as new species:

[1] Now with the Cuban Gulf Oil Company, Habana, Cuba.

Globigerina finlayi Bronnimann, n. sp.	smooth species
Globigerina hornibrooki Bronnimann, n. sp.	
Globigerina linaperta Finlay, 1939	
Globigerina pseudo-bulloides Plummer, 1926	
Globigerina stainforthi Bronnimann, n. sp.	
Globigerina taroubaensis Bronnimann, n. sp.	
Globigerina triloculinoides Plummer, 1926	
Globigerina turgida Finlay, 1939	
Globigerina collactea (Finlay), 1939	spinose species
Globigerina gravelli Bronnimann, n. sp.	
Globigerina primitiva (Finlay), 1947	
Globigerina soldadoensis Bronnimann, n. sp.	
Globorotalia compressa (Plummer), 1926	

The occurrence of these forms in the type locality samples is compiled in Table 1. Samples included by Cushman and Renz (1946, p. 7) in the list of type samples of the upper zone of the Lizard Springs formation, but now considered of doubtful stratigraphic position, as well as the allochthonous sample Sh. 100, from the mud-flow in the Kapur Ridge-Stone River area, have been omitted.

1. The distribution of the *Globigerina* species confirms the biostratigraphic subdivision of the Lizard Springs formation into two zones proposed by Cushman and Renz on the different life ranges of *Rzehakina epigona* (Rzehak) var.[2] *lata* Cushman and Jarvis, and var. *minima* Cushman and Renz and other benthonic species. *G. pseudo-bulloides, G. taroubaensis, G. turgida,* and *G. collactea* occur in the upper zone, whereas *G. triloculinoides* and *Globorotalia compressa* appear to be confined to the lower zone of the Lizard Springs formation. The *Globigerina* distribution furthermore shows that the upper zone of the Lizard Springs formation is faunistically closely related with that of the lower Eocene Ramdat marl of the Navet formation. With the exception of *Globigerina,* n. sp. (see p. 21 of this paper) all the *Globigerina* species of the Ramdat marl also occur

[2] The original terminology of "var." is adopted in this paper but the term should be replaced by subspecies. See also under species descriptions.

Species	Lower zone of Lizard Springs formation						Upper zone of Lizard Springs formation					Soldado formation						Navet fmn. Ramdat marl
	50316	50505	50506	50507	50509	50510	50504	50511	50512	50514	50515	6912 b,c	7299	110019	48143	5801 5802 5803	5845a 5847 5847a	59892
Globigerina finlayi			X		X						X							
Globigerina hornibrooki	O	O	●	X	●	●	O		X	X		X		X	X	X	X	O
Globigerina linaperta	●	●	O	●	●	●	O	O	O	●	X	O	X	X	O	O	●	O
Globigerina pseudo-bulloides							●	X	●	●	●	X			X			●
Globigerina stainforthi		X			X				X									
Globigerina taroubaensis								O	X									O
Globigerina triloculi-noides					O	X												
Globigerina turgida										X	X							O
Globigerina collactea									O	O		X		X	O	X	X	O
Globigerina gravelli		X			X	X	X	X	O	X	X							X
Globigerina primitiva	X	X	O	O	X	X	X		O	X	X			X	X			
Globigerina soldadoensis	●	●	●	X	O	X	●	●	●	●	●	X		X	O	O	●	●
Globorotalia compressa					X													

Table 1: Occurrence of some Paleocene-Lower Eocene Globigerinas and Globorotalias in the type localities of the Lizard Springs formation, Soldado formation, and Ramdat marl, Navet formation.
X = Rare O = Common ● = Abundant

in the upper zone of the Lizard Springs formation. Despite a possible ambiguity in the tectonical interpretation of the type locality one must place the upper zone of the Lizard Springs formation between the lower zone of the Lizard Springs formation and the Ramdat marl. On the other hand, *G. finlayi, G. stainforthi,* and *G. primitiva* have not been found in the Ramdat marl.

2. Based on the simultaneous occurrence of the zonal marker *Globorotalia wilcoxensis* var. *acuta* and *Globorotalia crassata* var. *aequa* (Bolli, 1950) in the neritic Soldado formation (Vaughan and Cole, 1941) and in the deeper water facies of the lower zone of the Lizard Springs formation, this lower zone must be considered the time equivalent of the Soldado formation. Nevertheless it must be pointed out that the *Globigerina* assemblages of the two facies are slightly different. Rare specimens of *G. pseudo-bulloides* and *G. collactea,* both absent in the lower zone of the Lizard Springs formation, have been recorded from the Soldado type locality. Furthermore, *G. finlayi, G. stainforthi, G. triloculinoides, G. gravelli,* and *Globorotalia compressa* have been found in the lower zone of the Lizard Springs formation but not in the Soldado formation. From the distribution of these planktonic forms it could be concluded that the type samples of the Soldado formation are stratigraphically higher than those of the lower zone of the Lizard Springs formation, but they would still be within the zone of *Globorotalia wilcoxensis* var. *acuta.*

3. The faunistic break between the Upper Cretaceous *Globotruncana mayaroensis* zone and the lower Tertiary *Globorotalia wilcoxensis* var. *acuta* zone is reflected by the stratigraphic distribution of the Globigerinidae. Excepting for some very rare and reworked specimens, none of the Upper Cretaceous species of the *Rugoglobigerina - Plummerita* (=*Plummerella*)[*] group (Bronnimann, 1952) have been found in the Paleocene Lizard Springs, Chaudiere, and Soldado formations and none of the Paleocene Globigerinae here described are known from the Maestrichtian formations. It is difficult to find in Trinidad the precursors of the simply structured Paleocene

[*] *Plummerita* Bronnimann, Cont. Cushman Found. Foram. Res., vol. III, pts. 3, 4, 1952, p. 146 new name for *Plummerella* Bronnimann, 1952, not De Long, 1942.

Globigerinae amongst any of the Upper Cretaceous representatives, which in ornamentation, apertural and umbilical features are so highly differentiated. The only group of Cretaceous Globigerinae from which the Paleocene forms could have sprung is represented by *G. cretacea* and allied species. The morphology of the *G. cretacea* group, especially the features of the aperture, is not yet sufficiently well known. This, and the fact that Globigerinae of the *G. cretacea* group have not yet been encountered in the post-*Globotruncana lapparenti* zones of the Trinidad Upper Cretaceous, renders this possibility of derivation rather speculative. It is of interest to note that of all the trochoid Upper Cretaceous Globigerinae only the representatives of the *G. cretacea* group are coiling in both directions thus indicating phylogenetic youth. The Rugoglobigerinae invariably coil predominately dextrally. The Paleocene Globigerinae on the other hand, coil in both directions and are, therefore, not yet specialized. The number of available specimens was too small to investigate this feature statistically, and the preference for dextral or for sinistral coiling as observed in *G. soldadoensis, G. collactea,* and *G. triloculinoides* may be purely accidental. Should this preference for one particular direction be confirmed then the earlier evolutionary stages of these species characterized by random coiling would have to be looked for in pre-*Globorotalia wilcoxensis* var. *acuta* and post-*Globotruncana mayaroensis* zones which by the unconformable overlap of the Paleocene formations on the Upper Cretaceous are cut out in the uplift areas of Trinidad. The fossiliferous Bontour sandstone and the Corax glauconite, both of Maestrichtian age, are remnants of such Upper Cretaceous formations not yet found in their stratigraphic position.

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of *Globigerina decepta* Martin, *Globigerina nitida* Martin, and *Globigerina marksi* Martin; to N. de B. Hornibrook, Wellington, New Zealand, for topotypes of *Globigerina primitiva* (Finlay), *Globigerina collactea* (Finlay), *Globigerina linaperta* Finlay, and *Globigerina turgida* Finlay; to Ruth Todd, United States National Museum, Washington, D. C., for specimens of *Globorotalia compressa* (Plummer), *Globigerina pseudo-bulloides* Plummer, and *Globigerina triloculinoides* Plummer from U.S.G.S. locality, No. 5617, Naheola formation, Alabama; and to C. D. Ovey, British Museum (Natural History), London, for Globorotalias and Globigerinas from the Velasco formation of Mexico, determined by T. F. Grimsdale.

SYSTEMATIC DESCRIPTIONS

Family GLOBIGERINIDAE

Genus GLOBIGERINA

Globigerina soldadoensis Bronnimann, n. sp. Plate 1, figs. 1-9

The low trochoid test is composed of about two volutions. The four-chambered, occasionally five-chambered adult is lobulate in typical specimens. The spiral side is centrally more or less elevated, the umbilical side is convex. The umbilicus is large and deep showing the arcuate apertures of the later formed chambers. The subglobular chambers increase gradually in size. They are rounded to slightly flattened peripherally and distinctly elongate in the direction of the axis of the test. At the umbilical side the chambers tend to become somewhat pointed. The end chamber can be smaller than the penultimate one or even rudimentary. Except for the indistinct sutures of the early ontogenetic stage, those of the spiral side are deep and curved in the direction of coiling, or they are oblique giving the impression of an overlapping arrangement of the chambers. The sutures of the umbilical side are straight throughout. The large arcuate apertures of the last formed chambers are provided with minute liplike borders. The walls are perforate and rather thick. The surface is covered with irregularly distributed papillae which are stronger and more prominent on the early chambers of the adult whorl; they are absent or weakly developed near the aperture of the end chamber. The species is predominantly coiled sinistrally.

Holotype.—Globigerina soldadoensis Bronnimann, n. sp., Plate 1,

figures 4-6. Rz. 287; T. L. L., Cat. No. 50506. Coiling: sinistral. Dimensions: maximum diameter of test, 0.35 mm.; end chamber, radial diameter, 0.125 mm.; tangential diameter, 0.23 mm.; height, 0.25 mm.

Remarks.—At first, an attempt was made to differentiate three types on account of the number of chambers and rudimentary chambers, on the degree of peripheral flattening of the chambers, and on the general outline of the adult test. It was found, however, that this subdivision could not be maintained in a consistent way and, therefore, the three types, which are illustrated on Plate 1, figures 1-9, were united in the same species. The greatest diameters of the figured specimens are 0.3 mm., 0.35 mm. and 0.425 mm. The radial diameter of the end chamber varies from 0.1 mm. to 0.15 mm. and the height of the end chamber from 0.25 mm. to 0.32 mm. The diameter of the aperture is from 0.05 mm. to 0.1 mm. *G. soldadoensis* differs from *Globigerina primitiva* (Finlay), 1947 by the ellipsoid-lobulate outline, by the obliquely arranged chambers and their rounded margins, and by the less pointed umbilical portions of the chambers.

G. soldadoensis is one of the most characteristic Globigerinae of the Trinidad Paleocene. It seems to be related to the spinose *Globigerina decepta* Martin, 1943 and *Globigerina nitida* Martin, 1943 both described from the Eocene Lodo formation of California. The comparison of the Trinidad forms with the holotypes of those species proved that *G. soldadoensis* is different from those forms. *G. decepta* Martin (holotype, Stanford University Collection, No. 7399, Lodo formation, L.S.J.U. loc. M-74, Sample, No. S-7-119, Lodo Gulch, Panoche Quad., Fresno Co., California, Coll. R. T. White) resembles *G. soldadoensis* in the granular surface, but it is clearly separated from *G. soldadoensis* by the much more pronounced planoconvex test, the oppressed chambers with distinct umbilical points, the rather rounded outline, the almost closed umbilicus and the small arcuate aperture. *Globigerina nitida* Martin (holotype, Stanford University Collection, No. 7400, L.S.J.U. Loc. M-74, Sample, No. S-7-47, Lodo Gulch, Panoche Quad., Fresno Co., California, Coll. R. T. White) is affined to *G. decepta*. The margin of *G. decepta* is more rounded and the chambers are more oppressed than in *G. nitida*, otherwise the two species are similar and possibly could be synonymous. This, however, can only be decided by the investigation of complete assemblages. The holotype of *G. nitida* is coiled dextrally, that of *G. decepta* sinistrally. Six out of eight topotypes of *G. decepta* and three

out of eight topotypes of *G. nitida* are coiled to the right. Although these Californian forms and *G. soldadoensis* are separate species, they belong to a closely related group of Eocene Globigerinas with granulate surface.

Occurrence.—Both zones of the Lizard Springs formation, rare to abundant; Soldado formation, rare to common; Ramdat marl, abundant.

Globigerina primitiva (Finlay), 1947 Plate 1, figs. 10-12

Globoquadrina primitiva Finlay, 1947, New Zealand Jour. Sci. Tech., Wellington, vol. 28, No. 5, p. 291, pl. 8, figs. 129-134.

The low trochoid subquadrate test is composed of about two volutions, the last of which is four chambered. The spiral side is almost plane to slightly elevated; the umbilical side is convex. The chambers gradually increase in size and are flattened peripherally. They are subangular at the margin and elongate in the direction of the axis of the test; the umbilical portions are pointed. The chambers are almost perpendicular to each other and descend in the course of growth thus producing an overlapping arrangement. The sutures of the final stage are well defined, oblique to curved in the direction of coiling at the spiral side, and straight to slightly curved umbilically. The umbilicus is deep but rather small showing the large arcuate apertures of the end chamber and occasionally also of the penultimate chamber. The apertural face is flattened and makes an angle with the outer wall of the chamber. The walls are finely perforate. The surface is covered with minute papillae which are stronger on the umbilical points of the chambers and virtually absent in the neighborhood of the apertures. The species is represented by left and right hand coiled specimens.

Holotype.—*Globoquadrina primitiva* Finlay, 1947, New Zealand Jour. Sci. Tech., Wellington, vol. 28, p. 291, pl. 8, fig. 133. Loc. F. 5179B, North Otago, Hampden Beach Section, upper blue micaceous clays, 1¼ mile N. of Kakaho Creek, New Zealand, lower Bortonian, middle Eocene.

Remarks.—Finlay assigned this spinose species to the genus *Globoquadrina* Finlay, 1947, type species *Globorotalia dehiscens* Chapman, Parr and Collins, 1934, from the Oligocene (Bakombian) at Kackeraboite Creek, Port Philip area, Victoria, Australia. According to Finlay (p. 290) *Globoquadrina* "combines the open umbilicus,

terminal face and apertural flaps of *Globotruncana*, the angular ventrally pointed chambers of *Globorotalia*, and the general compact shape of *Globigerina*, and plainly should not be referred to any one of these." It is doubted, however, whether the features of *Globorotalia dehiscens* really warrant the erection of a new genus differing from *Globigerina*. The aperture of *Globoquadrina primitiva* is clearly that of a *Globigerina* to which genus this species is here referred.

Six out of 10 specimens of *G. primitiva* are coiled dextrally. The maximum diameter of Trinidad specimens ranges from 0.2 mm. to 0.375 mm., the average is about 0.3 mm. The end chamber of a specimen with 0.3 mm. greatest diameter, measures 0.225 mm. in tangential direction and also in height. Topotypes from Finlay's locality F. 5179B are identical with the Trinidad specimens. The greatest diameter of topotypes ranges from 0.2 mm. to 0.3 mm. The end chamber of a specimen with maximum diameter of 0.3 mm. measures 0.25 mm. in tangential direction and also in height. Eight out of 11 topotypes coil to the left.

Occurrence.—Both zones of the Lizard Springs formation, rare to common; Soldado formation, rare.

In New Zealand, this species is recorded from the Danian to the middle Eocene. Obscure specimens were found according to Finlay in the Upper Cretaceous (?Teurian).

Globigerina gravelli Bronnimann, n. sp. Plate 1, figs. 16-18

The large spinose, low trochoid test is composed of about two volutions, the final one with five to six oppressed chambers. The outline is ellipsoid and only slightly lobulate. The spiral side is more or less convex. The subcircular umbilicus is large and deep, exposing the arcuate apertures of the last formed chambers. The chambers are subglobular, flattened peripherally, elongate in direction of the axis of the test and somewhat pointed at the umbilical side. The sutures are curved in the direction of coiling and well marked except those of the early stage. The large arcuate apertures with minute liplike borders open directly into the umbilicus. The walls of the early chambers are more coarsely perforate and pitted than those of the final chambers. The surface is covered with papillae. Those at the umbilical points are strongly developed. At

the apertural faces they are absent or rare. The species is coiled in both directions.

Holotype.—*Globigerina gravelli* Bronnimann, n. sp. Plate 1, figures 16-18. Rz. 287; T. L. L., Cat. No. 50506. Lower zone of Lizard Springs formation, Guayaguayare area, south Trinidad. Coiling: dextral. Dimensions: maximum diameter of test, 0.425 mm., end chamber, radial diameter, 0.125 mm., tangential diameter, 0.2 mm., height, 0.25 mm. Diameter of umbilicus, ±0.125 mm.

Remarks.—The spinose surface refers this species to the characteristic group of spinose Globigerinae represented in the Trinidad Paleocene by *G. soldadoensis, G. primitiva,* and *G. collactea.* It differs from these forms by the large size, greater number of the closely oppressed chambers in the last whorl, and the large, subcircular umbilicus. The four to five-chambered *G. collactea* which resembles closely in its general form *G. gravelli,* is much smaller. The species is named for the late D. W. Gravell in recognition of his contributions to the knowledge of orbitoidal Foraminifera.

Occurrence.—Both zones of the Lizard Springs formation, rare to common; Ramdat marl, rare.

Globigerina collactea (Finlay), 1939 Plate 1, figs. 13-15

Globorotalia collactea Finlay, 1939, Roy. Soc. New Zealand, Trans. Proc., vol. 69, p. 37, pl. 29, figs. 164-165.

The outline of the rather small and low trochoid test is ellipsoid and not much lobulate. About $2\frac{1}{2}$ volutions composed of small, oppressed chambers were counted. The final whorl is four to five chambered. The spiral side is elevated across the initial portion. The umbilicus is variable in size but as a rule large enough to expose the apertures of the three to four later chambers. The well-defined sutures are straight to slightly curved in the direction of coiling. The oppressed subglobular chambers increase gradually in size, the end chamber, however, can be equal to or even smaller than the penultimate one. The chambers are peripherally flattened, elongate in the direction of the axis of the test and pointed umbilically. The aperture of the end chamber is arcuate and leads directly into the umbilicus. A minute liplike border was noticed. The walls are perforate and the surface is covered with papillae which are stronger on the umbilical points than on the outer

chamber walls. The species is coiled in both directions, with preference for the right.

Holotype.—*Globorotalia collactea* Finlay, 1931, Roy. Soc. New Zealand, Trans. Proc., vol. 69, p. 327, pl. 29, fig. 164. From locality F. 5540, Hampden Beach section, North Otago, New Zealand, Heretaungan, lower Eocene.

Remarks.—On account of the position of the arcuate apertures, which are distinctly umbilical, this small spinose species belongs to *Globigerina*, although the low trochoid spiral and the convex spiral side suggest a *Globorotalia*. The dimensions of the figured specimen (Pl. 1, figs. 13-15) are: maximum diameter, 0.275 mm.; end chamber, radial diameter, 0.1 mm.; tangential diameter, 0.15 mm., and height, 0.15 mm. Coiling: sinistral. The maximum diameter of other specimens is from 0.25 mm. to 0.35 mm. with an average of about 0.175 mm. Twelve out of 15 specimens coil to the right. The Trinidad material agrees with topotypes from New Zealand which, like the Trinidad specimens, vary greatly in the development of the umbilicus. The elevation of the spiral side is also rather variable. The maximum diameter of topotypes ranges from 0.25 mm. to 0.3 mm., the average is about 0.275 mm. Nine out of 11 topotypes are coiled to the right.

Occurrence.—Upper zone of the Lizard Springs formation, common; Soldado formation, rare to common; Ramdat marl, common.

Globigerina, sp. aff. **G. triloculinoides** Plummer, 1926 Plate 2, figs. 1-3

The broad oval outline of the small trochoid test is slightly lobulate. About two volutions are developed, the last of which is four chambered. The spiral side is slightly convex. The umbilicus is shallow. The subglobular, peripherally flattened chambers rapidly increase. The distinct sutures are curved in the direction of coiling. The small arcuate aperture is opened into the center of the umbilicus and is provided with a prominent lip. The walls are perforate and the surface is finely pitted. The maximum diameter is 0.275 mm., the end chamber measures in tangential direction 0.186 mm., in radial direction 0.16 mm., and in height 0.175 mm. The diameter of the aperture is $\pm$0.05 mm. The test is coiled sinistrally.

The description refers to a single specimen found in locality Rz. 287, T. L. L., Cat. No. 50506, lower zone of the Lizard Springs

formation. It shows affinities to *G. triloculinoides* Plummer with which it is associated.

Occurrence.—Lower zone of Lizard Springs formaton, very rare.

Globigerina hornibrooki Bronnimann, n. sp. Plate 2, figs. 4-6

The medium-sized test is a trochoid spiral of about $2\frac{1}{2}$ volutions of which the final one is four chambered. The rounded outline is weakly lobulate. The subglobular chambers are rapidly increasing in size with the exception of the end chamber which is smaller than the penultimate one, peripherally flattened, and elongate in the direction of the axis of the test. The small umbilicus is deep enough to expose the apertures of earlier chambers. The well-defined sutures are straight in the end stage but curved in the direction of coiling in the early portion of the test. The large arcuate aperture is umbilically situated, elongate and provided with a minute liplike border. The walls are finely perforate. The surface is pitted. The species is coiled to both sides.

Holotype.—*Globigerina hornibrooki* Bronnimann, n. sp., Plate 2, figures 4-6. Rz. 287; T. L. L., Cat. No. 50506. Lower zone of Lizard Springs formation, Guayaguayare area, south Trinidad. Coiling: dextral. Dimensions: maximum diameter, 0.28 mm.; end chamber, radial diameter, 0.045 mm.; tangential diameter, 0.145 mm.; height, 0.175 mm.

Remarks.—*G. hornibrooki* differs from *G. linaperta* and *G. finlayi* essentially in the arrangement of the chambers (*finlayi*) and in the development of the end chamber (*linaperta*). In perforation and pitting, *G. hornibrooki* is very similar to these species. The greatest diameter ranges from 0.22 mm. to 0.3 mm., the average is about 0.28 mm. Five out of eight specimens are coiled to the right. The species is named for N. de B. Hornibrook, Wellington, New Zealand.

Occurrence.—Both zones of the Lizard Springs formation, rare to abundant; Soldado formation, rare; Ramdat marl, common.

Globigerina sp. aff. **G. hornibrooki** Bronnimann, n. sp. Plate 2, figs. 13-15

The subglobular trochoid test is composed of about 12 chambers arranged in $2\frac{1}{2}$ volutions. The final volution is four chambered. The subglobular chambers increase in size rapidly with the exception of the final chamber, which is strongly flattened peripherally and

elongate in the direction of the axis of the test. The end chamber, as a rule, is not larger or even smaller than the penultimate one. No umbilical points are developed. The umbilicus is small but deep and shows apertures of earlier chambers. The depressed sutures are straight in the end stage but slightly curved in the direction of coiling in the early spiral. The large elongate aperture is umbilically situated and almost hidden under the overlapping end chamber. The apertural face forms an obtuse angle with the outer chamber wall. The walls are perforate and thin. The surface is pitted, and no papillae have been found at the umbilical side. The species is coiled to both sides.

The figured specimen (Plate 2, figures 13-15) originated from locality Rz. 286; T. L. L., Cat. No. 50505, lower zone of Lizard Springs formation, Guayaguayare, south Trinidad. Coiling: dextral. Dimensions: maximum diameter, 0.35 mm.; end chamber, radial diameter, 0.135 mm.; tangential diameter, 0.275 mm.; height, 0.3 mm.

Remarks.—This rather scarce species differs from the likewise four-chambered *Globigerina hornibrooki* by the much larger subglobular test, the deep, umbilical aperture, and the strongly flattened end chamber. It is possible that transitional forms occur between this subglobular type and *G. hornibrooki*. The maximum diameter of additional specimens measures from 0.3 to 0.4 mm., the average lies around 0.32 mm. The direction of coiling appears to be undetermined: three out of six specimens coil to the right.

Occurrence.—Lower zone of Lizard Springs formation, rare.

Globigerina linaperta Finlay, 1939 Plate 2, figs. 7-9

Globigerina linaperta Finlay, 1939, Roy. Soc. New Zealand, Trans. Proc., Wellington, vol. 69 p. 125, pl. 13, figs. 54-57.

The low trochoid test with its predominant end chamber is composed of about two volutions, the last of which is four chambered. The spiral side is slightly convex, occasionally plane. The shallow umbilicus shows the apertures of the two later formed chambers. The subglobular chambers are flattened peripherally occasionally somewhat pointed umbilically and elongate in direction of the axis of the test. The chambers are almost at right angles; they increase rapidly in size and the end chamber is equal to or even larger than the whole preceding spiral. The straight sutures are well defined, with the exception of those of the early stage. The large arcuate aperture of the end chamber is directed into the umbilicus and sur-

rounded by a minute liplike border. The walls are perforate and the surface is pitted. The early chambers are rather coarsely pitted and their umbilical portions are distinctly papillate. The species has random coiling.

Holotype.—*Globigerina linaperta* Finlay, 1939, Roy. Soc. New Zealand, Trans. Proc., Wellington, vol. 69, p. 125, pl. 13, fig. 56. From locality F. 5179A, beach, 1 mile N. Kakaho Creek, Hampden, New Zealand. Bortonian, middle Eocene.

Remarks.—This species was described in a general way by Finlay so that a more detailed description is justified. *G. linaperta*, a dominant species of the Trinidad Paleocene, shows considerable variability in the pitting of the surface and in the development of the end chamber which can be smaller or of equal size or even larger than the preceding spiral. The degree of peripheral flattening of the chambers of the final whorl is also rather variable. Associated forms, related to *G. linaperta* in their general appearance and in the texture of the surface but with different arrangement of the chambers of the final whorl and different development of the end chamber, are described in this paper as *G. finlayi* and *G. hornibrooki*. The maximum diameter of the figured specimen is 0.332 mm., the end chamber has a radial diameter of 0.2 mm., a tangential diameter of 0.26 mm. and a height of 0.26 mm. The specimen coils to the left. The greatest diameter of other Trinidad specimens ranges from 0.25 mm. to 0.35 mm. Six out of 10 specimens coil to the left.

G. linaperta is in the general features related to *G. triloculinoides,* which, however, can be separated by the fine perforation and by the flaring lip covering most of the aperture. Globigerinae closely resembling *G. linaperta* are known from the younger Tertiary of Trinidad. The possible relationship of these forms with those from the Paleocene is yet to be investigated.

Topotypes of *G. linaperta* were compared with the Trinidad specimens which completely agree with the latter. The greatest diameter of the topotypes varies from 0.275 mm. to 0.427 mm., the average is about 0.35 mm. The direction of coiling appears to be undetermined as 7 out of 13 specimens are coiled sinistrally.

Occurrence.—Both zones of the Lizard Springs formation, rare to abundant; Soldado formation, rare to abundant; Ramdat marl, common.

Globigerina finlayi Bronnimann, n. sp. Plate 2, figs. 10-12

This species resembles *Globigerina linaperta* Finlay from which it differs by the arrangement of the chambers. The final whorl is composed of only three chambers and the fairly large arcuate aperture lies centrally at the intersections of the umbilical sutures. The end chamber is situated across two preceding chambers, whereas in *G. linaperta* it is situated across three chambers. The umbilicus is shallow and in well-preserved specimens exposes also the aperture of the penultimate chamber. The species coils in both directions.

Holotype.—*Globigerina finlayi* Bronnimann, n. sp., Plate 2, figures 10-12. Rz. 287; T. L. L., Cat. No. 50506. Lower zone of Lizard Springs formation, Guayaguayare area, south Trinidad. Coiling: dextral. Dimensions: maximum diameter, 0.312 mm.; end chamber, radial diameter, 0.15 mm. tangential diameter, 0.24 mm. height, 0.245 mm.

Remarks.—This rare and conspicuous species is clearly defined by the arrangement of the chambers of the final whorl and by the central positon of the aperture. Two other specimens of locality Rz. 287 have a maximum diameter of 0.275 mm. and of 0.3 mm.; one of the specimens is coiled dextrally, the other sinistrally.

G. finlayi comes close to *Globigerina eocaenica* Terquem, 1882 which, however, has the aperture located asymmetrically, at the base of the apertural face and to one side of the center of the last chamber (Terquem, 1882, pl. 9, fig. 4; Bandy, 1919, p. 120, pl. 23, figs. 2a-c). Another three-chambered species similar to *G. finlayi* with a central aperture, but belonging to *Globigerinoides,* is also known from Oligocene of Trinidad. The species is named for the late H. J. Finlay.

Occurrence.—Both zones of the Lizard Springs formation, rare.

Globigerina taroubaensis Bronnimann, n. sp. Plate 2, figs. 16-18

The relatively small subglobular test is characterized by an accessory chamber across the umbilicus. The trochoid spiral of about two volutions contains four chambers in the last whorl. The oppressed subglobular and peripherally somewhat flattened chambers increase rapidly in size. The radial sutures are shallow and indistinct throughout. The small umbilicus is almost completely covered by the

accessory chamber, the aperture of which is very small. Apertures of earlier chambers are not visible. The walls are coarsely perforate. The surface, including that of the accessory chamber, is roughly pitted. The species is coiled in both directions.

Holotype.—*Globigerina taroubaensis* Bronnimann, n. sp., Plate 2, figures 16-18. Rz. 413; T. L. L. Cat. No. 59892. Ramdat marl, lower Eocene, near San Fernando, south Trinidad. Coiling: dextral. Dimensions: maximum diameter, 0.25 mm.

Remarks.—*G. taroubaensis* Bronnimann, n. sp. differs by the small subglobular test with roughly pitted surface and by the relatively large accessory chamber across the umbilicus from all other nonspinose Globigerinae described in this paper. It can easily be distinguished from the lobulate and highly trochoid *G. turgida* which also carries an accessory chamber. The maximum diameter ranges from 0.22 mm. to 0.28 mm., average about 0.25 mm. Six out of 12 specimens are coiled to the right. The species is named after the Tarouba River near San Fernando, Trinidad.

Occurrence.—Upper zone of Lizard Springs formation, rare to common; Ramdat marl, common.

Globigerina turgida Finlay, 1939 Plate 3, figs. 1-3

Globigerina linaperta var. *turgida* Finlay, 1939, Roy. Soc. New Zealand, Trans. Proc., vol. 69, p. 125 (no figures).

The large lobulate test is a high trochoid spiral of about two volutions, the last of which is composed of four chambers. The subglobular chambers increase rapidly in size. They are peripherially slightly flattened and separated by deep and straight sutures. In about half of the investigated specimens, a small subglobular chamber is added across the umbilicus. This accessory chamber, with its smooth surface and minute perforations, is situated perpendicularly to the much larger end chamber of the final whorl. The large arcuate aperture of the accessory chamber is surrounded by a broad liplike border. The walls of the normal chambers appear to be thick, and compared with the accessory chamber, coarsely perforate. The surface is pitted and no spines are developed. The species is coiled to both sides.

Holotype.—*Globigerina linaperta* Finlay var. *turgida* Finlay, 1939. Locality F. 3310, Pahi marl, upper Bortonian, New Zealand,

Remarks.—*G. turgida* from the middle Eocene Bortonian of

New Zealand, was introduced as a variety[1] of *G. linaperta*. *G. turgida*, however, differs from *G. linaperta* in the arrangement of the chambers to such an extent, that it has to be considered as a distinct new species. In addition *G. turgida* in the adult develops a small accessory chamber across the umbilicus which has never been seen in *G. linaperta*. A similar form has been described by Glaessner (1937, p. 29, pl. 1, figs. 1a,b) as *G. bulloides* d'Orbigny var. *cryptomphala* Glaessner, from the upper middle Eocene (rare) and the upper Eocene (abundant) of the northern Caucasus, Russia. It differs from the Trinidad and New Zealand species by the more lobulate test and by the deviating arrangement of the accessory chamber which is formed over the aperture of the end chamber, *i.e.* parallel and not perpendicular to the end chamber. Glaessner's form is probably a new species and not a variety of *G. bulloides*. Bandy (1940, p. 119, pl. 22, figs. 2a-c) figured as *G. dissimilis* Cushman and Bermudez from the Jackson Eocene of Alabama, a species which could be synonymous with Glaessner's *G. cryptomphala*. It differs from the typically Oligocene *G. dissimilis* which has a bridgelike accessory chamber with two openings across the umbilicus. *G. onachitaensis* Howe and Wallace var. *senilis* Bandy (p. 121, pl. 22, figs. 5a-c), from the Jackson Eocene of Alabama, appears to be closely related to the species reported by Bandy as *G. dissimilis* and most probably represents the stage without accessory chamber. The relationship between the forms described by Bandy and Glaessner's *G. cryptomphala* should be investigated by means of study of the original material.

The greatest diameter of the figured specimen (Plate 3, figures 1-3) is 0.475 mm.; the end chamber measuring in tangential direction, 0.175 mm. and in radial direction, 0.15 mm. The species coils dextrally. The greatest diameter of additional Trinidad specimens measures from 0.35 to 0.53 mm., the average is around 0.47 mm. Topotypes from Finlay's locality F. 3310, marl, 1 mile NW. of Pahi, Paparoa, Matakohe S. D., North Auckland, New Zealand, middle Eocene Pahi marl, Bortonian, are identical with the Trinidad specimens. The maximum diameter of the topotypes varies from

[1] Variety in this paper has been used in the original terminology but the term "variety" should be replaced by subspecies. See also footnote 2.

0.45 mm. to 0.58 mm., with an average of about 0.5 mm. Eight out of 15 topotypes are coiled dextrally.

Occurrence.—Ramdat marl, common; upper zone of Lizard Springs formation, rare.

Globigerina, n. sp. Plate 3, figs. 4-6

The highly trochoid test is composed of $2\frac{1}{2}$ to 3 volutions, the last of which is five chambered. The outline is subcircular, lobulate. The subglobular chambers increase gradually in size and the dimensions of those of the final whorl do not differ much from each other. The umbilicus is filled with matrix. The aperture is not known. The indistinct sutures are straight in the adult stage, those of the early whorls curved in direction of coiling. The initial portion is similar to that of *G. pseudo-bulloides*. The walls are finely perforate. The surface is smooth. Two specimens coil to the left.

Remarks.—Only two specimens were encountered, the larger of which is illustrated on Plate 3, figures 4-6. They differ from all other Paleocene - lower Eocene Globigerinae, and it was not possible to refer them to any of the known species recorded in the Catalogue of Foraminifera. They probably belong to a new species, the available material, however, is inadequate to establish a new species. The maximum diameter of the figured specimen is 0.45 mm. and the height, 0.425 mm.

Occurrence.—Ramdat marl, very rare.

Globigerina pseudo-bulloides Plummer, 1926 Plate 3, figs. 7-9

Globigerina pseudo-bulloides Plummer, 1926, Univ. Texas, Bull., No. 2644, pp. 133-134, pl. 8, figs. 9a-c; Plummer, 1937, Pub. Lab. Pal., Univ. Moscow, Prob. Pal., vols. 2-3, pl. 4, figs. 31 a-c; Plummer, 1942, Cushman Lab. Foram. Research, Contr., vol. 18, pl. 8, figs. 3, 4.

The outline of the five, rarely six-chambered adult is lobulate. The spiral side of the trochoid test is either elevated in the center, showing the small initial spire composed of minute chambers, or it is almost plane, rarely depressed. The umbilicus is rather small. The subglobular chambers increase rapidly in size as added. In apertural view they are rather high and peripherally flattened. The sutures of the adult stage are deep and straight, those of the early chambers distinctly curved. The small arcuate aperture of the end chamber opens into the umbilicus and is bordered by a lip which varies considerably in width from specimen to specimen. The walls

are perforate. The surface is pitted and the umbilical portions of the early chambers of the adult whorl are covered with minute papillae. Left and right hand coiled specimens were observed.

Holotype.—*Globigerina pseudo-bulloides* Plummer, 1926, University of Texas, Bull., No. 2644, pl. 8, fig. 9a. Plummer figured (1926, pl. 8) three different specimens, and the first specimen is taken to represent the dorsal view of the holotype. From Station 23, shallow ditch at road corner southeast of new Corsicana reservoir, on the road to Mildred, Texas, upper Midway.

Remarks.—*G. pseudo-bulloides* is a characteristic and well-defined species with relatively constant features of the upper zone of the Lizard Springs formation and of the Ramdat marl. Six-chambered specimens were rare in Plummer's material (p. 133) and in the Trinidad assemblages. The greatest diameter ranges from 0.2 mm. to 0.4 mm. that of the specimens from the Midway formation goes up to 0.4 mm. Twenty-eight out of 44 specimens coil to the right. Three specimens from the Naheola formation, U. S. G. S. locality, No. 5647, measure 0.275 mm., 0.3 mm., and 0.325 mm. The two larger specimens are typical for the species, with thin and transparent walls, broader liplike borders and slightly less elevated spiral side than the average Trinidad specimens; they coil to the left. The smaller specimen is not typical, almost plane, less lobulate, and coils to the right. The comparison of *G. pseudo-bulloides* with *G. cretacea* d'Orbigny from the Upper Cretaceous of Trinidad shows that the two species are in number, arrangement and size of chambers in the adult, and also in the greatest diameter of the test (maximum diameter of four specimens 0.325 mm. to 0.4 mm) similar. The multiple apertures mentioned by Plummer (1926, p. 133) as diagnostic for *G. cretacea* may also be found in *G. pseudo-bulloides* and in all Globigerinas with large umbilicus. Where the umbilicus is small or virtually closed, only the aperture of the end chamber is visible, but where the umbilicus is large, the apertures of two or three or more of the later formed chambers can be seen. It appears that apart from stratigraphic differences, certain morphologic differences exist between *G. pseudo-bulloides* and *G. cretacea.* The sutures of *G. cretacea* are always straight and radial whereas those of *G. pseudo-bulloides* are distinctly curved to oblique in the early ontogenetic stage. Further, the spiral side of *G. cretacea* is, as a rule, more

or less plane or even depressed across the initial portion, the early chambers are larger and the surface of the chambers is, perhaps with the exception of the end chamber, provided with well-spaced minute pustules. These differences between *G. pseudo-bulloides* and *G. cretacea* are small and often difficult to ascertain. It is of interest to note that left and right hand coiled specimens occur in both species.

Occurrence.—Soldado formation, rare; upper zone of the Lizard Springs formation, common to abundant; Ramdat marl, abundant.

The quantitative differences in the distribution of this species are striking and appear to be useful for the biostratigraphic subdivision of the Paleocene deposits.

Globigerina stainforthi Bronnimann, n. sp. Plate 3, figs. 10-12

The medium-sized trochoid test of about two volutions is lobulate in its general outline. The last volution is invariably composed of four chambers. The spiral side is elevated and the central spire clearly shows the trochoid arrangement of the minute early chambers. The small umbilicus is shallow. The subglobular chambers increase gradually in size. The end chamber, however, is equal to or smaller than the penultimate one. The arcuate aperture with its large liplike border is opening into the umbilicus. The well-defined sutures are oblique in the early and straight in the final stage. The walls are finely perforate. The surface is pitted, more coarsely on the early than on the final chambers. The species is coiled to the right and to the left.

Holotype.—*Globigerina stainforthi* Bronnimann, n. sp., Sh. 100, 30 feet augerhole, T. L. L. Cat. No. 143838, Kapur Stone area, Guayaguayare, south Trinidad. Coiling: sinistral. Dimensions: maximum diameter, 0.287 mm.; end chamber, radial diameter, 0.125 mm.; tangential diameter, 0.175 mm.

Remarks.—The elevated spiral side and the arrangement of the sutures brings this species in relationship to *G. pseudo-bulloides* from which it differs by the four adult subglobular chambers and the large arcuate aperture with broad liplike border. The maximum diameter ranges from 0.15 mm. to 0.3 mm., the average is about 0.175 mm. Eight out of 14 specimens are coiled to the right. The species is named after R. M. Stainforth for his contributions to the micropaleontology of Trinidad.

Occurrence.—Both zones of the Lizard Springs formation, rare. Sh. 100, 30 feet augerhole, T. L. L., Cat. No. 143838, Kapur Stone area, Guayaguayare, south Trinidad.

Globigerina triloculinoides Plummer, 1926 Plate 3, figs. 13-18

Globigerina triloculinoides Plummer, 1926, Univ. Texas, Bull., No. 2644, pp. 134-135, pl. 8, figs. 10 a-c; Plummer, 1937, Pub. Lab. Pal. Moscow University, Prob Pal., vols. 2-3, pl. 4, figs. 33 a-b; Plummer, 1942, Cushman Lab. Foram. Research, Contr., vol. 18, p. 43, pl. 8, figs. 1,2. (See further references in Plummer, 1942.)

The trochoid test is composed of $1\frac{1}{2}$ to 2 volutions, the last of which contains four subglobular chambers. The chambers increase rapidly in size and the last one almost equals in size the whole preceding spiral. The spiral side is plane to slightly depressed across the initial portion. The umbilicus is shallow. The straight sutures are well marked; those of the spiral side are almost at right angles. The arcuate aperture with its more or less prominent lip is opening into the umbilicus. The thin walls are perforate. The surface is pitted, early chambers rather coarsely, and small papillae occur on the umbilical portions of the inner chambers of the last whorl. The species is coiled in both directions, with preference to dextral coiling.

Holotype.—*Globigerina triloculinoides* Plummer, 1926, University of Texas, Bull. No. 2644, pl. 8, fig. 10a (spiral side of type); from Station 23, shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Texas, upper Midway.

Remarks.—The Trinidad specimens agree with Plummer's description and figures of *G. triloculinoides* (Plummer, 1926, pl. 8, figs. 10a,b). The maximum diameter of the investigated specimens ranges from about 0.125 mm. to 0.37 mm. Plummer noted 0.35 mm. usually less, for the greatest diameter. The development of the protruding lip appears to be variable. Sixteen out of 21 specimens coil dextrally. Three specimens of *G. triloculinoides* from U.S.G.S., locality No. 5647, Naheola formation, Midway, upper fossiliferous horizon, greensand bed, Naheola Landing on Tombigbee River, Choctaw Co., Alabama, were compared with the specimens from Trinidad. The Naheola specimens have a greatest diameter of 0.262 mm., 0.275 mm. and 0.287 mm. and delicate and transparent walls. Arrangement and size of chambers, umbilicus and apertural features are identical with those observed in the Trinidad material. It is

not quite clear why this species was named *triloculinoides* as the final whorl is invariably composed of four chambers.

Occurrence.—Lower zone of Lizard Springs formation, rare to common. Upper zone of Lizard Springs formation, doubtful specimens only. Sh. 100, 30 feet augerhole, T. L. L. Cat. No. 143838. Kapur Stone area, Guayaguayare, south Trinidad.

Family GLOBOROTALIIDAE

Genus GLOBOROTALIA

Globorotalia compressa (Plummer), 1926 Plate 2, figs. 19-24

Globigerina compressa Plummer, 1926, Univ. Texas, Bull., No. 2644, pp. 135-136, pl. 8, fivs. 11a-c; Plummer, 1937, Pub. Lab. Pal., Moscow Univ., Prob. Pal., vols. 2-3, pl. 4, figs. 32a-c; Plummer, 1942, Cushman Lab. Foram. Research, Contr., vol. 18, p. 44, pl. 8, figs. 5, 6.
(For further references see Plummer, 1942.)

The axially compressed trochoid test has a broad ellipsoid, lobulate outline. The final volution is composed of five, occasionally of six chambers. The spiral side is slightly depressed. The umbilicus is small, rather shallow, but distinct. The chambers increase gradually in size; they are axially compressed and the peripheral margin is bluntly angular. The chambers are overlapping at the spiral side. The well-defined sutures are curved in the direction of coiling at the spiral side, and more or less straight umbilically. The aperture is distinctly interiomarginal, extending from the umbilicus toward the periphery of the test. The aperture and part of the umbilicus are covered by a flaring lip. The walls are thin and extremely finely perforate. The surface is smooth. The species coils in both directions, apparently with slight preference for the left side.

Holotype.—*Globigerina compressa* Plummer, 1926, Univ. Texas Bull., No. 2644, pl. 8, fig. 11a. (Although the holotype is not especially designated it has to be inferred from the explanation on p. 184, that figure 11a is the dorsal view of the holotype); from Station 23 (p. 135), 24 in explanation to plate 8; Station 23 is probably correct as Plummer remarks (p. 50) that "this has been chosen as the type locality for a number of new forms." Shallow ditch at road corner southeast of new Corsicana reservoir on the road to Mildred, Texas, upper Midway.

Remarks.—Cushman (1942, p. 44) observed that *Globigerina compressa* from the Naheola formation should possibly be placed

under *Globorotalia*. The compressed test and the obtusely angular chambers are suggestive that this species could be a *Globorotalia* to which genus it is here assigned on account of the interiomarginal aperture as typically developed in *Globorotalia menardii* and related forms. The Trinidad specimens agree with those described by Plummer from the Midway of Texas, and with a specimen from U.S.G.S. locality 5647, Naheola formation. The maximum diameter of the figured specimens from Trinidad is 0.212 mm. and 0.231 mm. The Naheola specimen, which coils to the left, has a greatest diameter of 0.25 mm. and Plummer records an average of 0.3 mm. and an upper extreme of 0.4 mm. for the Midway material.

Occurrence.—Lower zone of Lizard Springs formation, rare. Sh. 100, 30 feet augerhole, T. L. L. Cat. No. 143838, Kapur Stone area, Guayaguayare, south Trinidad.

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PLATES

PLATE I (II)

EXPLANATION OF PLATE 1 (11)

Figures — Page

1-9. **Globigerina soldadoensis** Bronnimann, n. sp. 3

Rz. 287; T.L.L., Cat. No. 50506. Lower zone of Lizard Springs formation, south Trinidad. Holotypes, figures 4-6.

10-12. **Globigerina primitiva** (Finlay) 11

Rz. 287; T.L.L., Cat. No. 50506. Lower zone of Lizard Springs formation, south Trinidad.

13-15. **Globigerina collactea** (Finlay) 13

Rz. 413; T.L.L., Cat. No. 59892. Ramdat marl, type locality, near San Fernando, south Trinidad.

16-18. **Globigerina gravelli** Bronnimann, n. sp. 12

Rz. 287; T.L.L., Cat. No. 50506. Lower zone of Lizard Springs formation, south Trinidad. Holotype.

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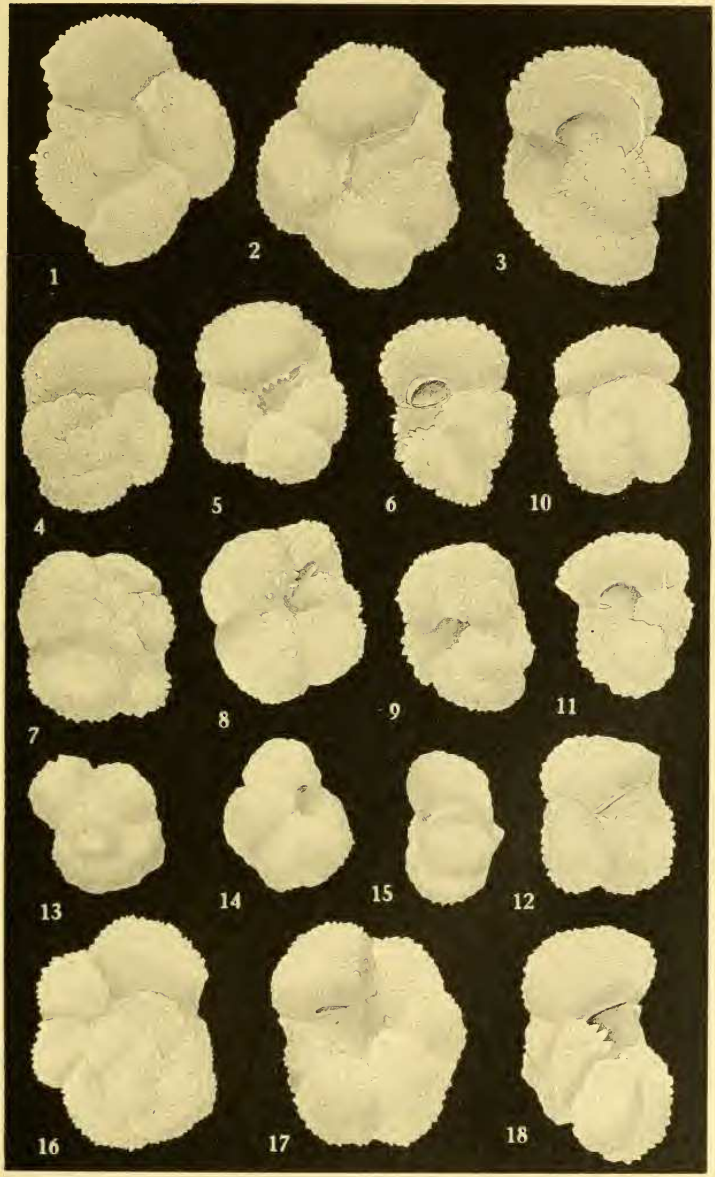
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PLATE 2 (12)

EXPLANATION OF PLATE 2 (12)

Figures — Page

1-3. **Globigerina** sp. aff. **G. triloculinoides** Plummer 14

Rz. 287; T.L.L., Cat. No. 50506. Lower zone of Lizard Springs formation, south Trinidad.

4-6. **Globigerina hornibrooki** Bronnimann, n. sp. 15

Rz. 287; T.L.L., Cat. No. 50506. Lower zone of Lizard Springs formation, south Trinidad. Holotype.

7-9. **Globigerina linaperta** Finlay 16

Rz. 287; T.L.L., Cat. No. 50506. Lower zone of Lizard Springs formation, south Trinidad.

10-12. **Globigerina finlayi** Bronnimann, n. sp. 18

Rz. 287; T.L.L., Cat. No. 50506. Lower zone of Lizard Springs formation, south Trinidad. Holotype.

13-15. **Globigerina** sp. aff. **G. hornibrooki** Bronnimann, n. sp. 15

Rz. 286; T.L.L., Cat. No. 50505. Lower zone of Lizard Springs formation, south Trinidad.

16-18. **Globigerina taroubaensis** Bronnimann, n. sp. 18

Rz. 413; T.L.L., Cat. No. 59892. Ramdat marl, type locality, near San Fernando, south Trinidad. Holotype.

19-24. **Globorotalia compressa** Plummer 25

Sh. 100, 30 feet augerhole; T.L.L., Cat. No. 143838. Kapur Stone area, south Trinidad.

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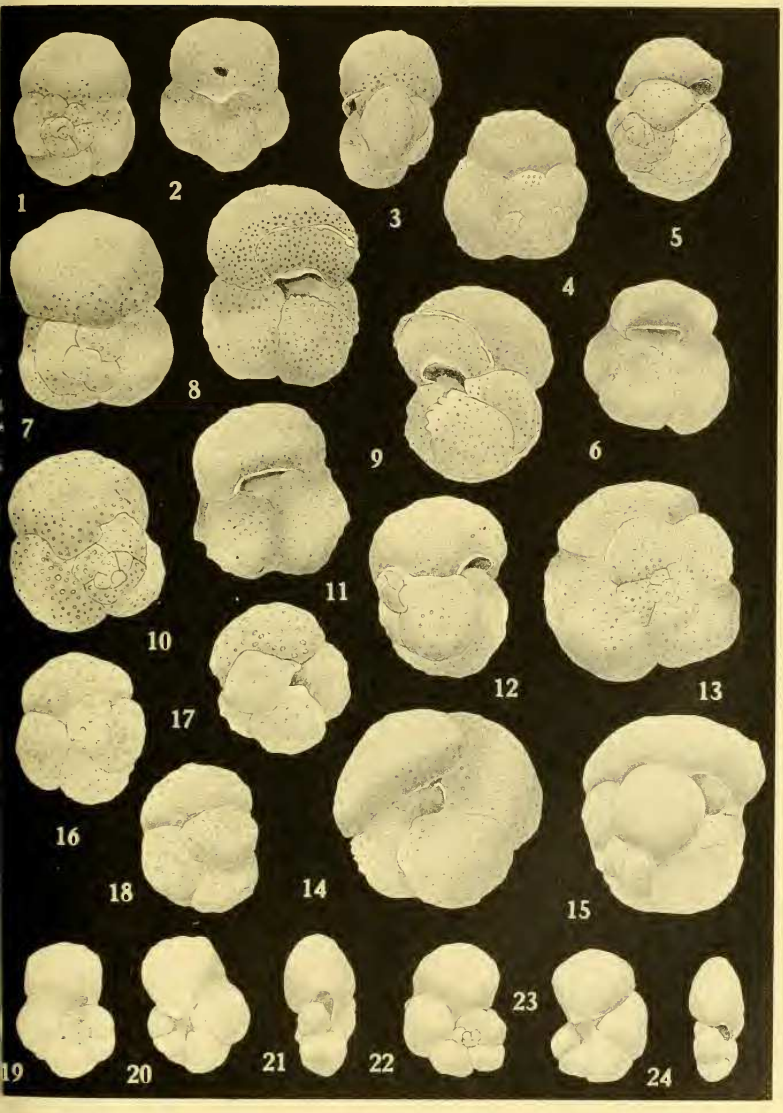
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Plate 3 (13)

EXPLANATION OF PLATE 3 (13)

Figures — Page

1-3. **Globigerina turgida** Finlay 19

Rz. 413; T.L.L., Cat. No. 59892. Ramdat marl, type locality, near San Fernando, south Trinidad.

4-6. **Globigerina**, n. sp. 21

Rz. 413; T.L.L., Cat. No. 59892. Ramdat marl, type locality, near San Fernando, south Trinidad.

7-9. **Globigerina pseudo-bulloides** Plummer 21

Rz. 281; T.L.L., Cat. No. 50314. Upper zone of Lizard Springs formation, south Trinidad.

10-12. **Globigerina stainforthi** Bronnimann, n. sp. 23

Sh. 100, 30 feet augerhole; T.L.L., Cat. No. 143838. Kapur Stone area, south Trinidad. Holotype.

13-18. **Globigerina triloculinoides** Plummer 24

Sh. 100, 30 feet augerhole; T.L.L., Cat. No. 143838. Kapur Stone area, south Trinidad.

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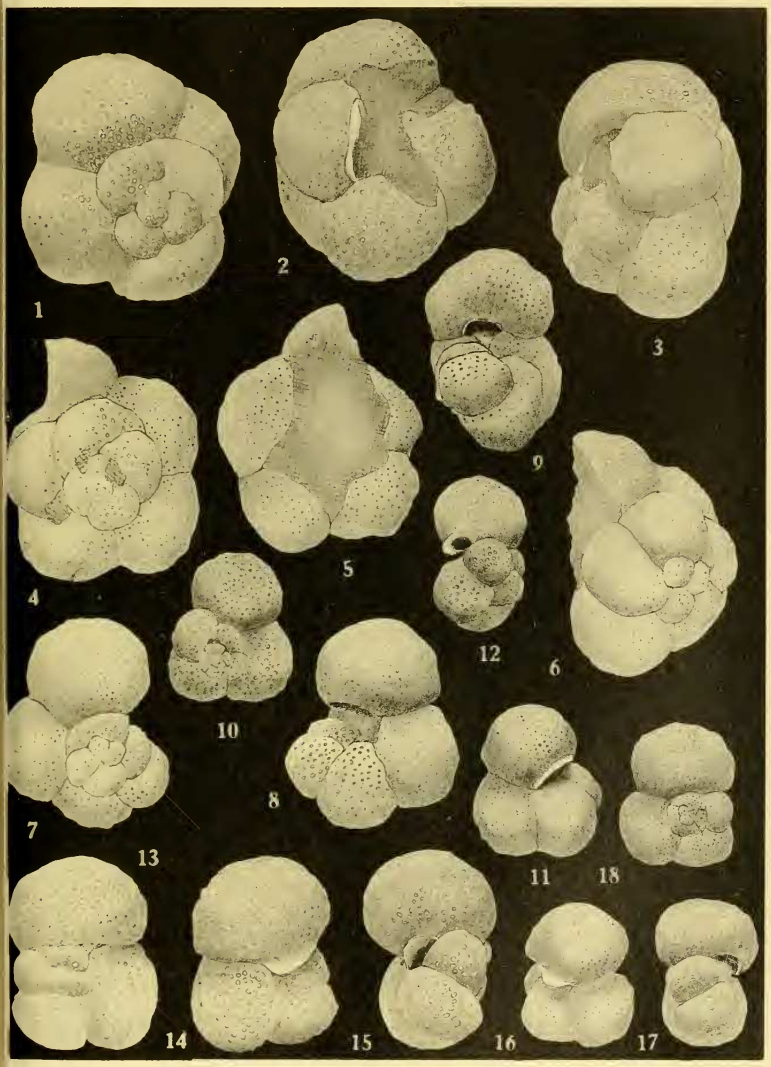
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